

Learning Theories

By: Lauren Quinto

ARCS Model of Motivational Design by John Keller

John Keller explains four steps that need to be met in order to have students motivated in the learning process. These four steps should be used in math, or any subject to increase motivation in students on a day to day basis. First off, educators need to gain the attention of the students. Teachers can gain this attention by direct sensory stimuli or by stimulating curiosity. Secondly, information has to be relevant to the learner. We are more inclined to learn when we can build on prior knowledge and apply it to our lives. Thirdly, we need to build up confidence in our students. A student who knows their expectations and has a chance to take small steps in the learning process will become motivated. Lastly, a student needs to have satisfaction in their work through achievement, praise, or through entertainment. It is important to look at the student as a whole. By modelling these steps in the classroom, students will realise their ability to succeed when working with numbers.

Cognitive Load Theory of Multimedia Learning by John Sweller

Our long term memory acts as “central management” and stores different plans. This directly affects how information is created in our working memory.

Intrinsic cognitive load describes that all types of instruction/ideas have a level of difficulty that cannot be changed. They can only be broken down into smaller steps to assist in learning. Extraneous cognitive load is the idea that instruction/ideas can be taught under the control of the instructor. Ideas presented in a complicated manner will cause cognitive overload. Germane cognitive load is the most promoted type of cognitive load. The focus is on processing, constructing, and the automation of plans.

When teaching mathematical concepts, we want to focus on reducing extraneous cognitive load. Math teachers need to find ways to simplify difficult concepts and teach students how to solve problems in steps. Math teachers should also focus on relating concepts to student's lives to help reduce cognitive overload. Other ways to reduce cognitive load is to only assign important practise problems that build on prior knowledge.

Discovery Learning by Jerome Bruner

Discovery learning is when students attempt to solve problems on their own by using previous knowledge and experiences to discover and learn facts and relationships. Students will more likely remember the concept by discovering it themselves rather than being directly taught by a teacher or a textbook. This will encourage active engagement,

promote motivation, responsibility, independence, and develop creativity and problem solving skills. However, teachers need to be aware that it can create cognitive overload and prevent teachers from identifying problems and misconceptions.

The beauty of mathematics is there is more than one way of solving a problem. Providing students with the opportunity to discover techniques and strategies to solve math problems will build confidence and might lead to an interest in the topic. To avoid cognitive overload, the students would benefit with guided discovery where the teacher provides different prompts in an activity which will help structure student thinking. Discovery learning is a great way for students to make math their own.

Problem Based Learning (PBL)

Giving students the opportunity to apply new knowledge to different real world situations is problem based learning. The teacher will provide students with challenging, open ended questions that do not have “right” answer. Everyone will work on a key problem that is identified and then agree on a solution. Students are encouraged to work with small groups to collaborate and be active investigators and problem solvers. Instead of the teacher directing, they take the role as facilitators of learning.

Fermi problems are excellent ways to have students think critically about the key problem. They will use prior knowledge of mathematics and personal experiences to creatively come up with a solution. Students will more likely be motivated if they can connect to the problem as well. Students will be able to transfer mathematical knowledge to new situations. Open ended problems can be fun for students and show them that not every scenario has one answer.

